IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	**Confirmation No. 6169**
Marc ROBELET	:	Attorney Docket No. 2003-1731A
Serial No. 10/726,651	:	Group Art Unit 3747
Filed December 4, 2003	:	Examiner Marguerite McMahon
METHOD OF MANUFACTURE OF A PISTON FOR AN INTERNAL COMBUSTION ENGINE, AND PISTON THUS OBTAINED	:	**MAIL STOP: AMENDMENT**

REQUEST FOR RECONSIDERATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

THE COMMISSIONER IS AUTHORIZED TO CHARGE ANY DEFICIENCY IN THE FEES FOR THIS PAPER TO DEPOSIT ACCOUNT NO. 23-0975

Sir:

In response to the Office Action of April 10, 2006, Applicant kindly requests reconsideration of the rejections contained therein.

While on page 2 of the Office Action, claims 1 and 17-27 were rejected by the Examiner on the grounds of non-statutory obviousness-type double patenting over claims 1-5 of USPN 7,005,017 or claims 1-9 of USPN 6,994,758. Without acquiescing to the position set forth by the Examiner, enclosed herewith is a Terminal Disclaimer serving to overcome the this rejection. Accordingly, withdrawal of this rejection is respectfully requested.

On page 3 of the Office Action, claims 1-5 and 15 were rejected as being unpatentable over Tausig et al., USPN 6,311,759 (Tausig) in view of Kruse, USPN 6,286,414. However, it is respectfully submitted that the present invention as set forth in claims 1 and 17-27 clearly patentably distinguishes over Tausig and Kruse.

As an initial matter, it is noted that the rejection of claims 1 and 17-27 is overcome by the accompanying Terminal Disclaimer as discussed above. The Examiner indicated that claims 1-5 and 15 were rejected as being unpatentable over Tausig in view of Kruse. However, claims 2-5 and 15 stand as canceled. Accordingly, the statement on page 3 is inconsistent with the present state of the claims.

In the body of the rejection the Examiner made reference to claims 24 and 25 on page 4 and claims 17-23 on page 5, and thus implicitly these claims were also rejected by the Examiner.

However, there is no indication as to the status of claims 26 and 27. As such, the only indication of rejection is that based upon non-statutory obviousness-type double patenting. As this rejection as been overcome, all stated rejections with respect to claims 26 and 27 have been overcome. Accordingly, indication of the allowability of claims 26 and 27 is respectfully requested.

As has been discussed previously, the present invention is directed to a piston for an internal combustion engine and a method of manufacturing the piston in which the piston is made by heating a billet to an intermediate temperature between its solidus temperature and its liquidus temperature and then shaped by thixoforging to form the piston. This manner of making the piston makes it possible to make pistons for high-performance internal combustion engines by using a steel or other dense alloy that has high mechanical properties instead of a specially treated or shaped aluminum alloy, while providing a sufficiently reduced wall thickness after forging in order to provide a sufficiently low mass so as to obtain a high performance of the engine.

As discussed in the Background to the Invention, pistons are usually produced in one piece molded or forged aluminum alloy. However, increased stress conditions render such conventional pistons unsuitable. While various solutions have been proposed, these solutions are all quite expensive. The piston as a whole could be replaced with steel with comparable geometry, which would have a better resistance to mechanical and thermal stresses and to fatigue and better temperature resistance. However, because of the high density of the material, if the

piston were given a sufficiently low mass in order to obtain high performance of the engine, it would be necessary to arrive at a very reduced wall thickness after forging of the piston. Such a thickness is not possible using conventional forging techniques if, for reasons of costs, it is desired to continue producing pistons in one piece. However, the present inventor has found that it is possible to manufacture a piston having such reduced wall thickness in one piece by using a thixoforging process.

The primarily cited reference to Tausig does not relate to a thixoforging process, but a thixoforming process. A thixoforming process consists in:

a) casting a metal (feedstock material) into a mold, at a temperature just above the liquidus temperature and letting it solidify; see col. 2, l. 64 - col. 3, l. 4; and

b) partially remelting the material by heating it between its solidus liquidus temperatures and forming it to the desired shape.

Regarding the above step a), this step is absent from the thixoforging process according to the present invention. Furthermore, it is noted that it would be impossible to perform this in a satisfactory way if the material were steel, taking into account the very high liquidus temperatures involved, which are around 1500°C (see the examples of the specification, 1487°C and 1490°C). Precisely knowing on the spot the very precise liquidus temperature of a steel melt when it is prepared and cast is not possible. The necessary precision, on the order of 1°C, for determining in advance the temperature of step a) of Tausig could not be obtained by the relatively approximate calculation models. In addition, it would not be possible to measure and control the melt temperature with the required precision. The measurement could be made at best with a ± 5°C precision because of the lack of precise measuring methods, and also because of the lack of thermal homogeneity of the melts.

What is asserted in Tausig, at column 3, lines 42-65, concerning the temperature during the casting process may be true for casting of relatively low melting point metals and alloys (e.g. Al, Mg, Cu, Ti, etc.) but not for steels. Note also that there is a contradiction in the specification of Tausig. The specification discusses "high volume continuous casting" in column 3, lines 59-65, and its sophisticated temperature control systems, while the invention that Tausig protects

requires the casting of the metal into a mold, which could be a steel mold at ambient temperature (see e.g. claim 10). Using a steel mold at ambient temperature would be impossible for casting a steel part; the mold could possibly melt, and in all cases the molded steel would stick to the mold walls.

Accordingly, it may be seen that in one of ordinary skill in the art looking at Tausig would not be motivated to attempt the process of Tausig with steel. This is supported by the fact that none of the examples of Tausig demonstrate steel-all such examples concern Al alloys.

It should also be noted that the clutch hub, made of aluminum alloy in the example noted from column 8, line 29 of Tausig, is intended to replace a clutch hub that was previously made of forged steel. The most obvious solution for Tausig, then, if a clutch hub of steel was desired, would have been to use the same process as disclosed in Tausig for making steel clutch hubs. That is, the point of Tausig is to be able to make this part out of aluminum alloy through its thixoforming process. This fact is clearly indicative that the Examiner's proposed modification with Kruse is not obvious.

The Examiner cited Kruse as showing a one-piece steel piston formed by conventional forging. The Examiner considers that it would have been obvious to one having ordinary skill in the art to adapt the process of thixoforging to a piston. However, the problems with adapting this process to making a one-piece steel piston as alleged to be disclosed by Kruse, for example, are discussed above.

Further, it is noted that Kruse describes a very particular design for the piston, one which is intended to be used in difficult conditions. Note the discussions in Kruse at lines 19-20 of column 5 and again at lines 51-55 of column 5. Note also column 1, lines 15-20. The specification of Kruse provides a good deal of information on the design and function of the piston. However, the manufacturing process has very little detail. It is only noted that the body of the piston is made by forging; see column 2, lines 30-32, column 5, lines 16-20, 24-25 and 45-46, column 6, line 59 and claim 10 in column 7. The precise type of forging depends on its

temperature. It could be hot forging, warm forging or cold forging, and this is not specified in Kruse.

In addition, it is noted that their further operations are performed in order to obtain the final piston. The piston requires welding of the ring belt. Note the discussion in column 2, lines 21-23, column 3, lines 43-45 and 57-59, column 5, lines 30-33 and 43, and column 6, lines 59-61. The presence of this welding step results in the fact that it is not a one-piece piston as claimed; it is not formed from a metal part cast in one-piece.

With the present invention, the fabrication process and choice of material allows the manufacture of a light one-piece piston with walls having a variable and small thickness. This cannot be obtained by classical forging operations such as referenced by Kruse and Tausig. The process of Tausig does not correspond to the present invention, further, as the casting operation of Tausig is just above the liquidus temperature. Further, the process according to the present invention is less costly and easier to put into practice, particularly with respect to steel, as it could be performed on a steel block taken either from an ingot cast by a known process, or from a bloom/ingot cast by continuous casting. In both instances the casting is at temperatures that are at least 20 to 30°C above liquidus if the material is steel. Under these conditions, the globular structure that is necessary for thixoforging operations would be obtained without any difficulty during the heating that precedes the thixoforging. Note for example the discussion in the second paragraph on page 5 of the specification.

Thus it can be seen that Tausig requires two successive special operations, and the present invention avoids one of such operations in that the solid material can be obtained from known methods.

A further indication of the difference is the fact that in the forming step, in Tausig it is generally performed with a solid fraction of 60 to 80%. Note column 5, the last paragraph, column 9, lines 4-6, 17-20 and 27-28, as well as claims 6 and 7. With the present invention, the solid fraction can go up to 90%.

From the above discussions of both of these references, it is seen that it is not obvious to combine these references in the manner that has been proposed by the Examiner. While the

Examiner cites Kruse as showing a one-piece steel piston formed by conventional forging, it is not a metal part cast in one-piece, as discussed above. The Examiner considers it obvious to take the part of Kruse and adapt it to thixoforging to make the piston. However, as discussed above, it is clear that a steel piston as disclosed by Kruse, in order to be thixoforged, requires a number of considerations that are not addressed by either Kruse or Tausig. In other words, neither reference discloses or suggests to one of ordinary skill in the art how a steel piston could be thixoforged. There is insufficient discussion of the various factors that have to be taken into consideration in order to successfully do so. Thus the proposed combination is not in fact obvious to one of ordinary skill in the art, and is insufficient to suggest to one of ordinary skill in the art how to make and use the invention of any of the claims of the present application without undue experimentation.

The various additional points raised by the Examiner either do not need to be specifically addressed at this point in time in view of the above failure of the combination of Tausig and Kruse, or have been previously addressed; to the extent that they have been previously addressed, such previous discussions are incorporated herein by reference. Note for example the prior discussions with regard to Uggowitzer and Winter.

From the above it is respectfully submitted to be clear that all of the claims now pending in the present application patentably distinguish over all of the prior art references that have been cited by the Examiner. Indication of such is respectfully requested.

In view of the above remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicant's undersigned representative.

Respectfully submitted,

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PATENT OFFICE FEE TRANSMITTAL FORM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Attached hereto is a check in the amount of $250.00 to cover Patent Office fees relating to filing the following attached papers:

Petition for Extension of Time $120.00

Terminal Disclaimer $130.00

A duplicate copy of this paper is being submitted for use in the Accounting Division, Office of Finance.

Respectfully submitted,

THE COMMISSIONER IS AUTHORIZED TO CHARGE ANY DEFICIENCY IN THE FEES FOR THIS PAPER TO DEPOSIT ACCOUNT 23-0975

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